BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

PATENT SPECIFICATION

Application Date: May 20, 1921. No. 14,141/21. **183,005**

Complete Accepted: July 20, 1922.

COMPLETE SPECIFICATION.

Improvements in Drills.

I, NORMAN EDLOW WOODS, a citizen of the United States of America, Mechanical Engineer, of 247, 18th Avenue, in the City of Paterson, County of Passaic, State of New Jersey, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in drills of that class commonly known as twist drills in which the normal straight cutting edges are provided with one or more recesses, such recesses being continued in the form of a groove up the face of the tool.

Such drills were intended to obviate the defect found in drills not provided with such recesses, of each cutting lip cutting single heavy chips, which chips tended to lodge in the flutes and cause friction, loss of power and obstruction to the flow of lubricant to the cutting edges. It has been found however that although drills provided with such recesses to divide up the chips, the accumulation of these and their packing in the flutes of the drill, and consequent interruption of the flow of lubricant, has not been overcome.

The grooves in drills of this nature have been formed by milling the drill blade after the drill is twisted. This is a costly operation, and a more or less difficult one to perform accurately. As hereinafter described, I prefer to make the grooves in my drill of half-round form before the drill is twisted, with the result that the subsequent twisting action imparts to each groove a semi-elliptical or parabolically curved form as will be shown.

The general object of my invention is to provide a drill which overcomes the objections above noted, and which therefore is stronger and capable of resisting greater strains, and is less liable to fracture than twist drills of the type described, and which will more efficiently lubricate the work and allow freer clearance of the chips and cut faster with less resistance than any ordinary type of drill. Further specific objects of the invention are to provide novel means in a drill structure for securing the desired results.

With these objects in view, the invention consists in constructing a twist drill of the type described, in such a manner that the recesses or auxiliary grooves are disposed at different distances from the drill point.

The invention further consists in the modification whereby the groove or recess furthest from the drill point, is deeper than the inner or nearer groove or recess.

The invention further consists in forming the auxiliary grooves or recesses of semi-elliptical shape, the one furthest from the drill point being deeper than the inner one.

Figure 1 is a view in side elevation of twist drill embodying my invention.

Figure 2 is a plan view of the cutting end of the drill.

Figure 3 is a cross-section through the drill and an object being bored thereby.

Figure 4 is a diagrammatic plan view illustrating the cutting action of the lips.

Figure 5 is a diagrammatic view in elevation of the same.

Figure 6 is a view showing the divisions of the cuts and the chips formed by the cutting lips.

Referring to the drawing, 1 designates the body or shank of the drill, which is of the ordinary twist form, 2, and 3 the portions of the body forming the spiral cutting blades, 4 the central web connecting the inner edges of the blades, 5

[*Price* 1/-]

and 6 the flutes formed by and between the twisted blades, 7 the chisel cutting point at the outer end of the web, and 8 and 9 the cutting lips at the outer edges of the blades 2 and 3.

In carrying my invention into practice, I provide the face of each cutter blade 2 and 3 with a longitudinally extending channel or groove, the face of the blade 2 being provided with a groove or channel 10 and the face of the blade 3 with a groove or channel 11. These grooves or channels preferably extend throughout the length of the blades and intersect the cutting lips 8 and 9, thereby separating the respective cutting lips into a plurality of cutting portions. As shown, the groove 10 separates the lip 8 into alined cutting portions 10^a and 10^b, while the groove 11 separates the lip 9 into alined cutting portions 11^a and 11^b.

It will be observed that the grooves 10 and 11 of the cutters are staggered with relation to each other, that is arranged at different distances from the drill center, the lip 8 thus being separated by its groove 10 into a short straight inner cutting member 10^a and relatively longer straight outer cutting member 10^b, while the lip 9, on the contrary, is separated by the groove 11 into a relatively long straight inner cutting member 11^a and a relatively short straight outer cutting member 11^b. Each cutting lip, therefore, instead of forming a chip coextensive in width therewith, produces a chip which is divided into relatively narrow and wider sections, both materially narrower than the width of the lip, leaving an uncut ridge of a depth corresponding to the groove therebetween. This is clearly shown in Figures 4, 5 and 6, wherein a, a^1 and a^2 respectively designate the chip sections and ridge formed by the cutting lip 8 and b, b^1 and b^2 the chip sections and ridge formed by the cutting lip 9. By the division of the chips in the manner stated the objections incident to ordinary drills, in which each lip forms a single wide chip, are avoided, in that the sectional chip may be cut with greater freedom and ease and with a reduction of strain and friction, and the sections of the chip have greater ease of clearance, in that they will pass into and upwardly through the flutes in a free and easy manner, and without the tendency to bind therein and create great resistance and friction, as will chips of normal size. Accordingly, the working strains upon the drill will be materially reduced and a drill of a given size, and rotated at a given speed, may be operated to cut at greater speed than an ordinary drill and with less driving power. Furthermore, owing to the reduction of strain, the web 4 may be considerably reduced in thickness, with the effect of narrowing the point 7, and without weakening the drill, with the additional advantageous result of diminishing to a great extent the compression of the chips by the point of the drill, friction and undue heating of the drill point and chips being also thus reduced to a further degree.

In practice the grooves 10 and 11 of the cutters are preferably made deepest at the points where they intersect the lips 8 and 9 and then gradually diminish in depth toward the drill shank, and the groove 10 of one of the cutters is preferably made of less depth than the groove 11 of the other cutter, with the result of further reducing the sizes (widths) of the chips made by one cutter with respect to those made by the other, so that chips of different sizes will be formed which will more readily intermingle in their discharge to secure easy and rapid clearance. Another purpose of making the groove 11 deeper than the groove 10 is to allow greater clearance owing to its greater distance from the drill centre, and its greater ratio of cutting speed due to the larger circle in which it travels, also by such clearance, to precent burning of the cutting edge at the outer wall of the said groove 11 by high friction due to its speed. This deeper groove 11 also further promotes free supply of lubricant to the cutting surfaces.

It will be understood that by the arrangement of the grooves 10 and 11 in staggered relation, or at different distances from the center point 7, provision is made so that a cutting portion of each lip will remove the ridge left standing by the other lip, the cutting portion 10^b of the lip 8 removing the ridge b^2 formed by the lip 9, while the cutting portion 11^a of the lip 9 will remove the ridge a^2 formed by the lip 8, thus producing an absolutely smooth and finished bore. By reducing the thickness of the web 4, it will further be evident that the depth of the flutes or clearance channels 5 and 6 will be increased, ensuring still further reduction of friction and any tendency of the chips to pack or bind therein. It will, of course, be understood that the grooves 10 and 11 also provide flow channels for the passage of lubricant to the cutting surfaces. The grooves may be forged during the process of manufacture or cast in the drill in the process

of manufacturing a cast drill, or may be milled or otherwise formed in a drill whether prior to or after the working portion of the drill is twisted or made. I prefer to make the groove initially of half round form before the drill is twisted, as the result of such twisting action will be to impart to each groove the semi-elliptical or parabolically curved form shown. Such form of the groove, which is deepest toward the periphery of the drill and shallowest at its side nearest the center of the drill, results in the formation of a groove which allows freer clearance of the chips and also of the production of a more or less pronounced overhanging cutting edge or point *c* at the intersection of the wider end of the groove with the lip, which edge serves to make a clean cut and prevent any drag and the formation of any fins or ragged surfaces on the chips liable to cause friction and retard the clearance of the chips. Also said cutting edge tends to force the chips at right angles to the direction of rotation, thus centering them in the flutes and still further facilitating the clearance action.

It will be observed that the cutting point or edge *c* of groove 11 is longer or has a greater extent of overhanging projection than the edge *c* of groove 10, this being due to the fact that the groove 11 being farther from the drill center than groove 10, is distorted to a greater degree than groove 10 in the change of shape produced by the twisting of the drill blades. The described differences in the depth, shape and form and extent of projection of the cutting points *c* of the two grooves is of importance and great advantage because of the fact that groove 11 owing to its movement in a larger circle than groove 10, has greater work to do as hereinbefore stated, which must be properly provided and compensated for in order to secure efficiency of action of the drill as a whole.

It will be obvious that in addition to the functional advantages stated, the grooves 10 and 11 also serve to form a pilot or leader for the drill which guides the drill or causes it to run more accurately or centrally than a drill of ordinary type.

While I have specified the use of a single groove in each drill lip, which is sufficient in drills up to a certain diameter, it is to be understood that any desired or required number of grooves may be formed in each drill lip as may be found most advantageous in drills of different diameters.

In twist drills of ordinary construction the heel edges of the cutting members 2 and 3 generally extend to points or flukes, with the result that the flutes 5 and 6 are contracted thereby and the cutting members made of such irregular form and varying widths as to make it impossible to temper the drill evenly, or in such manner to be free from flaws. I overcome this objection by rounding the heel ends of the cutting members, as indicated at 12, thus widening the flutes 5 and 6 and removing an excess of metal adding to the difficulty in tempering the drill evenly. By this construction an added advantage is obtained, in that in the upward flow of the masses of chips through the flutes pockets or channels 12^1 are produced between the same and the surfaces 12, affording additional channels for the flow of lubricant to the cutting surfaces.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a twist drill of the type in which the normal straight cutting edges are provided with one or more recesses, such recesses intersecting the normal straight cutting edges, and forming minor straight cutting lips or edges, and extending up the face of the tool so as to form auxiliary grooves or flutes in the main grooves or flutes, the arrangement whereby said recesses or auxiliary grooves are disposed at different distances from the drill point.

2. A twist drill as claimed in Claim 1, in which that auxiliary groove or recess which is positioned on each cutting edge, farthest from the point of the drill, is deeper than the inner auxiliary groove or recess.

3. A twist drill having cutting lips each divided by a groove at a different distance from the axis of the drill into a plurality of cutting portions, each groove being of semi-elliptical form, the more distant one of said grooves being deeper than the other.

4. A twist drill substantially as described and shown.

Dated this 20th day of May, 1921.

For the Applicant.

FRANK B. DEHN,
Chartered Patent Agent,
53, Doughty Street, London, W.C. 1.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1922.

183,005 COMPLETE SPECIFICATION

1 SHEET

[This Drawing is a reproduction of the Original on a reduced scale]

Fig. 1.

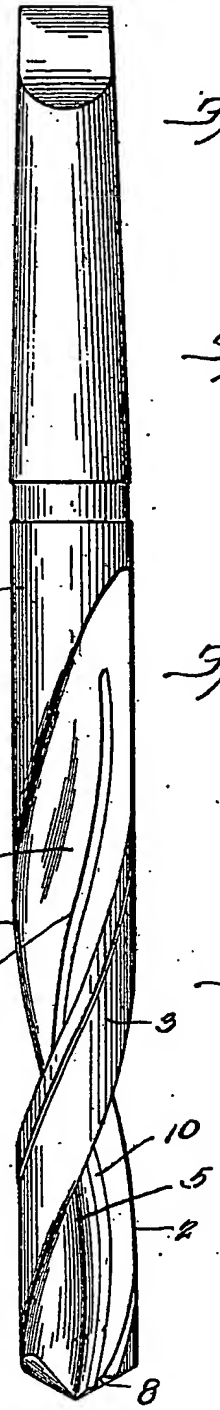

Fig. 4.

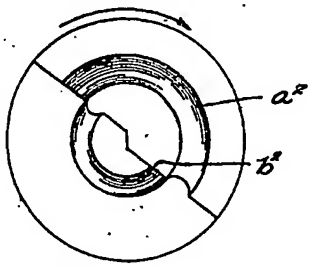

Fig. 2.

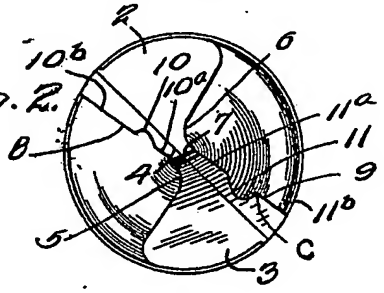

Fig. 3.

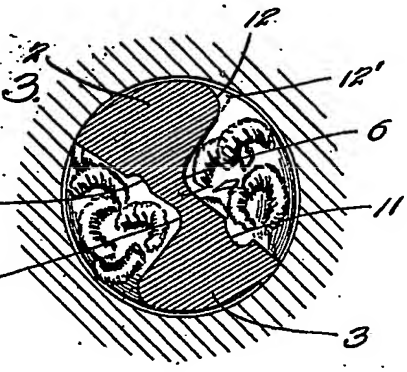

Fig. 5.

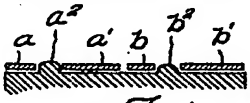

Fig. 6.

Malby&Sons, Photo-Litho